The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions relating to the proposed Export of Natural Gas from the Province of Alberta.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: October 2nd, 1951.

Volume 14.

E R R A T A

Volume	Page	Line	
13	1102	5	should read:

"the written document, but my position is quite futile if he wishes or is able to get all the details".

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I N D E X

VOLUME 14.

October 2, 1951.

W I T N E S S E S

E X H I B I T S

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VOLUME 14.

2 October 1951.

RALPH E. DAVIS (recalled)

already sworn, examined by Mr. Steer, testified as follows:

MR. STEER: Mr. Chairman, I need not qualify Mr. Davis, I am sure.

THE CHAIRMAN: No.

Q MR. STEER: You are familiar with the nature of these proceedings before the Board?

A Yes, sir.

Q And you will perhaps start by expressing your views generally on that situation.

A I shall be glad to. In the first place, most of my experience in the gas industry has been in the United States. There it is not possible under our constitution, as twice interpreted by the Supreme Court, for a State to deny the right to export gas from one State to another as that would be deemed an act in restraint of trade. In Canada it is, of course, different. Alberta has the right to deny the privilege of export, even to order its discontinuance under certain circumstances. I do not know which of these two fundamental policies is best for a nation or even for a State or for a Province. I incline to the opinion that export will be granted by Alberta whenever export should be granted, and when export should be granted will be when the need for gas in the home markets is assured for a reasonable time, maybe 30 years, maybe for more years. In any case, I do not

believe that a long distance large capacity pipeline can be financed -- I mean, from Alberta, I might say from anywhere -- until there is an assured supply of gas for the line for at least 20 years. A short line of modest capacity such as the proposed line from Southern Alberta into Montana could be financed because the danger of running short of gas would be less, and because the line would be relatively short it could pay out in much less time than a long line. I set forth this view briefly in testimony before this Board last year.

So I sum up my view as follows: The home requirements should be properly safeguarded for, say, 30 years. Were there no other fuel resources in Alberta I would lengthen that period, and whenever the time is truly ripe for export I believe it should be permitted. I have advised several of the applicants for export licenses that the time is not ripe. They have refused to believe me. I wish it clearly understood that I am not here to oppose export but I am here to assist in the efforts that apparently must be made by the Alberta gas utilities to preserve sufficient gas for the Alberta markets.

Q There have been references here, Mr. Davis, to the principles on which the Federal Power Commission grant orders for the construction of pipelines. Are you familiar with that procedure?

A Yes, sir.

Q Can you tell us about it?

A Yes. The Federal Power Commission grant or deny what

they term certificates of convenience and necessity. The broad situation is this, the total proven recoverable gas reserves in the United States at December 31st, 1950, were estimated by the Gas Reserves Committee of the American Gas Association at 185-6/10 trillion cubic feet. The annual additions to the reserves for some years past have been in the order of 12 to 15 billion cubic feet as determined by that Gas Reserves Committee. The annual withdrawals were from 6 to 7 trillion net. Now, when I say "net" I mean the gross withdrawals less the amount returned to storage, such as in fields that are being re-pressured, etc. In every recent year the net increase has generally been in excess of 6 trillion. That is, in a year they find 6 trillion feet in addition to the amount taken out during the year. In other words, gas has been found at more than double the rate of its withdrawal. In Texas and Louisiana the total proven recoverable reserves at December 31st, 1950, stood at 130-9/10 trillion cubic feet. That estimate again was made by the same authority. The net production of those two States in 1950 totalled 4-3/10 trillion, and their additions to reserves in 1950 totalled 9-3/10 trillion. A large part of this increase was in the Gulf Coast area where reserves stand at about 75 trillion. The additions last year were about 5 trillion and production approximated 2 trillion cubic feet. Those last figures dealing with the Gulf Coast are not based on the American Gas Association Committee's survey, they are based on studies and knowledge of those fields and data that I have

assembled. During the past few years, most of the major pipeline construction in the United States has been from the Gulf Coast.

The Federal Power Commission finds itself confronted with this situation, an applicant company may have from 12 to 20 or more times one year's requirements committed to it but deliverability of the annual withdrawal may be as low an amount as 8 or 10 years for full deliverability, although deliverability or availability of the gas for full requirements is for 15 years or more usually.

During the last war the Federal Power Commission granted certificates based more upon the need for the facility in the war program. Then came a period of more rigid control where deliverability for the full period of the proposed bond issue was required. An example of that would be the Michigan-Wisconsin Pipeline Company where they required practically not only reserves more than 20 times the expected annual requirements but deliverability for nearly the 20-year period. Then when we slowly came to realize -- "we", I mean, as a nation -- that we were in a dangerous struggle with Russia, the requirements were again modified, not officially but actually, to take account of the over-all situation, and whether they are conscious of it or not I sometimes wonder if expediency is not an influence.

No reserve estimates, so far as I know, have been approved by the Federal Power Commission where figure estimates are given for any reserves

classed as other than proven. They do give consideration to the reasonable expectancy of an applicant increasing its reserves if competent evidence shows that such increase is a reasonable expectancy.

Q You have had experience, too, with the Securities and Exchange Commission in the United States in relation to these matters?

A Yes, in matters relating to oil and natural gas financing, I have had experience over many years.

Q Will you tell us what that experience has been?

A Well, any seller of securities must get a stamp of approval from the Securities and Exchange Commission if the purchaser expects to distribute the securities. If there is to be no re-sale and a limited number of buyers, S.E.C. approval is not required. This means that except for certain bond issues practically all goes, through the S.E.C., all large.

Q And what, in your experience, does the Securities and Exchange Commission require in the matter of proof of reserve estimates?

A When dealing with a field where they have extensive knowledge, such, for example, as the Panhandle field of Texas, limited detail is required. For any field new to them sufficient detail is required to permit their geologists to form an independent judgment. Sometimes I have submitted a report and it has been approved without submitting any further information. At times I have submitted my working papers, where they are reviewed. Sometimes I meet them in conference and sometimes I have

appeared formally as a witness.

Q In your experience, does now the Securities and Exchange Commission accept estimates of reserves other than proved reserves?

A No, sir, they do not. I say they do not, I do not say they never have. In former years I secured approval of reports in which I estimated proven and semi-proven reserves, and I mean those reports were accepted, but during the last few years I have found that the Securities and Exchange Commission will not approve the publication of figures reflecting estimates of semi-proven or probable reserves. You can go in there with them but they will not permit you to print them in a prospectus for financing, and they give no weight to them. I do not know what they would say if I presented a report purporting to estimate possible reserves, but I do know it would not get into a final banking report.

Q Now, will you tell the Board the extent of your experience in dealing with reserves of gas as a base for financing pipelines?

A I will say that I believe that my reports have been used in connection with financing of probably more than 75 per cent of the total natural gas expansion programs in the United States and also in Canada for many years, 20 years or so, I believe. This includes all or most of such financing for a majority of the larger companies including the United Gas, Columbia Gas, Consolidated Natural Gas, Trans-Continental Gas Pipeline Company, Tennessee Gas, Texas Eastern, Texas Gas Transmission, Southern Natural,

People's Gas, Light and Coke Company in Chicago, Michigan-Wisconsin Pipeline Company, Michigan Consolidated Gas Company, Northern Natural, City Services(Subsidiaries), and many others. In Canada it includes Canadian Western, Northwestern Utilities, Union Natural Gas of Canada Limited, and Dominion Natural Gas Company Limited.

Q Now, in the preparation of reports on reserves for such financing, is it customary to make the classification that has been referred to here as proved, probable, possible?

A Generally I present an estimate only of proven reserves with a general discussion of the prospects for additional natural gas in the area of gas availability. In earlier years I included in a limited number of cases estimates of proven and semi-proven or probable reserves. I at times classed reserves as proven, and then a second class, semi-proven or probable. The Securities and Exchange Commission object to the inclusion of estimates of any reserves except proven, and in two or three instances insisted on such figures being deleted from our reports before approval was granted. In my annual reports to the Oklahoma Natural Gas Company I class reserves as proven and probable, but those reserves are for company use, not prepared for financing.

I would like also to make this statement, that there was a time between 25 and 30 years ago when there was objection to classing reserves as proven, semi-proven and probable. The objection was on the ground that these terms could be misconstrued. And in one rate case in Ohio I prepared a report in which

the reserved lands were classed as Class 1, Class 2, Class 3, Class 4, Class 4 being the wildcat stuff that had no indication of gas value.

Q Then it appears that you do not adhere strictly to the classification as proven for all of your work. Would you explain that?

A Well, in preparing reports for financing I find that estimates of probable or prospective or possible reserves, as I have said, are frowned upon by the Securities and Exchange Commission, hence I do not include such reserves in reports for financing, even though the report is not to be reviewed by the Securities and Exchange Commission. However, in work for other purposes, such as I mentioned for Oklahoma Natural, and in fact, for financing in earlier years, it was my custom to classify reserves as proven, semi-proven or probable, and as prospective. I do not recall ever having used the term "possible". It would have little meaning of the value.

Q Were you active in your present profession when the terms used in classifying reserves were being adopted?

A I think so, yes. I began my geological work in 1906. In fact, more than 10 years was engaged in work relating to metal mining. My very first job, which started in July 1906, had to do with prospecting for lead and zinc ores, and in that year I made some of my first estimates of ore reserves. About all we did then was to estimate proven reserves, and, incidentally, from drill-hole data. In 1911 a notable book was published by Herbert Hoover, then a famous mining engineer. Mr. Hoover discussed in

detail the necessity of using carefully chosen words to the end that the meaning would be unmistakable. His recommendations were, dealing now with metal mines, that the term "proved ore" should apply to ore where there is practically no risk of failure of continuity, practically no risk. "Probable ore", he said, was ore where there is some risk, yet warrantable justification for the assumption of continuity. And "prospective ore" he defined as ore which can not be included in the above classes nor definitely known or stated in any terms of tonnage. When man began making estimates of oil and gas reserves, it was evident that reserve estimates could at best in most cases be approximate.

(Go to page 1179)

Q Yes?

A The estimate of the quantity that seemed sure of realization was called proved. The difference between that figure and the large estimate of what seemed probable was called probable. In those cases where geologic factors indicated a reasonable expectancy of still greater recovery, such ore was called prospective. Where I have said "ore" in this case, I should have said oil and gas. I am talking about when oil and gas estimates were first being made. Now, those terms were all borrowed from the Mining Engineer. The term "semi-proven" seems to have been selected to express the idea that there was a substantial degree of proof that such reserves existed. In my judgment, the term "possible" has no place in reserve estimates, but it does have a place in discussions of the potentialities of an area or a region.

Q Now, have you any other authority to cite dealing with this, the meaning of these terms?

A Yes, sir. Dr.Hume expressed his idea or ideas of the meanings of these terms on pages 2, 3, 4 and 5 of the Hume Report of 1950, titled "Natural Gas Reserves of the Prairie Provinces."

Q Well, I think perhaps we won't read that, Mr. Davis.

A Yes, sir.

Q Everybody can have reference to it?

A Yes, sir. In any case, I would like to point out that Dr. Hume uses the word "proven" in a very strict sense.

Q Yes? Perhaps you would refer to that much of it?

A That is all I want to say.

Q Now, then, you have mentioned the Securities and Exchange

Commission?

A Yes, sir.

Q Should one expect to finance a major, should one expecting to finance a major pipe line in Canada think about the attitude of the Securities and Exchange Commission?

A I would state that they should, and for this reason: Any such project, whether it is a major pipe line, any such project will involve a large capital investment from $75,000,000.00 to $150,000,000.00, or up to and maybe more than $350,000,000.00. I know of only two sources with this kind of money, New York or Government subsidy. I assume that those hoping to finance such projects here expect to go to New York. If they can make a private deal involving not too many on the investing side, they can bypass the S.E.C., the Securities and Exchange Commission, but it is more likely that they will find it necessary to seek approval for their financing or of their financing by the Securities and Exchange Commission, and that is where it will lose interest in estimates of probable and possible reserves. I think it almost certain that insurance company money would have to be available.

Q Are you generally familiar with the requirements of gas supplies for the financing of a new natural gas pipe line?

A I am familiar generally.

Q And are you familiar with the present stage of gas supply in Alberta?

A I think I am.

Q Including home market requirements?

A I think so.

Q How long have you been active in the study of Alberta

reserves?

A Since 1925.

Q In what capacity?

A Well, in 1925, when New Yorkminterests acquired the Canadian Western Natural Gas Company, the Canadian Western Natural Gas, Light, Heat & Power Company it was called then, I was employed by Ford, Bacon& Davis to assist them in making a study of the property, and my end of the job was a study of the gas reserves. I think that was in December,1924. I believe it was either December '24 or December '25 when that work was undertaken. And since that time, without any formal retainer of any kind, but through frequent requests for service, I have served both the Canadian Western Natural Gas Company and Northwestern Utilities Limited in a consulting capacity. I think I have averaged, oh, possibly, on the average over 25 years, one or two visits a year to Alberta to study natural gas problems.

Q Yes? And when Canadian Western and Northwestern have made bond issues for expansion during that period, have you studied the reserves and furnished the reports to the bankers or other lenders of money?

A I have, I believe, in all cases. I believe in all cases.

Q And your interest in these matters has, primarily, been what?

A My interest in these matters?

Q Yes?

A My interest is the obligation to fulfil my duty with these utilities.

Q Now, several studies of reserves in the Viking-Kinsella

Field have been presented to the Board. What are those?

A Well, Dr. Hume reported on the reserves of that field, along with others. Mr. Liesemer, when engaged by the Board, made a study and a report. Dr. Nauss has presented studies of the field. And Mr.Dougherty, of DeGolyer & MacNaughton, has made such studies and presented a report. And I have made such studies and presented reports to the Board.

Q I think you made a tabulation of them?

A Yes, sir.

Q Perhaps you would like, with that tabulation, perhaps you would like to discuss several estimates that have been made?

A Well, I would like to talk a little about the several estimates.

Q Yes?

A In the Hume Report. . .

Q I think perhaps it might be convenient, Mr. Davis, if we distributed that analysis that you have made.

A We have some of them here.

Q Here we are. All right, Mr.Davis, perhaps you will discuss these estimates?

A Well, these figures have been put together. . .

THE CHAIRMAN: Mr.Steer, we might mark thatas Exhibit 35?

MR. STEER: Yes, sir.

ANALYSIS OF RESERVE ESTIMATES, VIKING-KINSELLA FIELD PREPARED BY MR. DAVIS, MARKED EXHIBIT 35.

Q MR. STEER: Go ahead, Mr. Davis.

A These figures have been taken from several reports that I have mentioned. I believe the figures are correct. Dr. Hume's report made back in 1947, and they would be carried forward, I believe, in his report of 1950, as I believe he made no change in his basic estimates. Dr. Hume estimated these reserves by both the volumetric method and what he calls the material balance method, and his figures are for total gas in place in the total of 1,116 billion in one method, and 1,287 billion in the other, and no estimate made of what gas would remain in the reservoir when no longer producing gas. Dr. Hume classed as proven 366,080 acres. He estimated the average sand thickness at 15 feet for that 366,080 acres. His porosity figure was 18%. The connate water figure 45.

Mr. Liesemer, whose report was made in 1949, gave an estimate of 609 billion feet recoverable gas, and estimated to an abandonment pressure of 200 pounds at the well head average for the field. He worked it out on the material balance method.

Dr. Nauss gave an estimate in November of 1950 of 842 billion cubic feet, which he classed as marketable. He used the same estimated area proven as Dr. Hume used, and I have the impression, without being certain, that his abandonment pressure, assumed abandonment pressure, was 100 pounds. I will not vouch certainly for that, but in any case he used 15-foot thickness, 18% porosity, and 45% connate water, the same as Dr. Hume.

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The DeGolyer & MacNaughton study made in January, of 1951, found by the volumetric method 743 billion, by the material balance method, 876 billion. I believe I have those figures right. I believe they used as, they would not say it was abandonment pressure, but it was the average pressure at the bottom of the hole, bottom hole pressure to which they estimated reserves of 150 pounds bottom hole. Their proven area is given as 496,806 acres, which is substantially larger than Dr. Hume or Dr. Nauss. And in addition to that they had an area of possible gas placed at 683,300 acres. For the proved area, I believe I am correct in saying, that their average pay thickness was 8.4 feet, and I think they used 1½ feet for the possible area. Their porosity figure was 20%, the connate water 45%.

Now, to the best of my knowledge, this figure of 45% connate water comes from some old tests that were run for the Humble Oil Company, not the Humble, Imperial Oil Company. I had access to those figures some years ago and I could not believe that the pay sand in the Kinsella Field was yielding the gas, as it was yielding it, with no more show of water than was shown, the wells of the size we were getting in Kinsella, having pay sand at 45% connate water. So that we took some cores of a number of wells, I do not recall now, that had been completed by Northwestern Utilities, and sent them down to a laboratory at Caspar, Wyoming, where the porosity and connate water was determined for a number of samples.

We had quite a wide variation in connate water. The lowest figure was 15%, as I recall, and the water ran up to more than 50%. I do not recall the top. But, in any case, the samples did run high in connate water, with tight shaly sand or sandy shale. The samples that ran 15 to 26% were fairly clean. It is difficult to get a sample and determine porosity and connate water for the more friable parts of the formation, because you cannot cut a core and make a test, and I regarded that part of the reservoir as being of at least 24% porosity, at least that, because I had samples that ran, I had even samples that would not hold together for making up a core, and I have an average of 24%. Well, the result of our studies of connate water and porosity, the result of it was that for porosity I used 24%, which you will notice is higher than any of the others, and connate water 21%, which is less than half of that used by the others. I am thinking about the reservoir that produces the gas, because that will be useful in a pipe line, and I am not much interested in gas that will stay there, or what the connate water is back 10 miles from the gas field. I applied my figures to an area of 245,202 acres, that acreage being determined by planimetering a map after a line indicating my judgment of the limits of commercial gas production had been drawn upon it. That is the reason for the odd figure ending with 202 acres. It was made to well head pressure average for the field at 200 pounds, and Imade two estimates, one by a volumetric study, where I had 585 billion, and that is corrected to

January 1st, 1950, and 612 billion by what is being called here the material balance method.

Now, I forgot to mention my sand thickness. You will see there I used 7.8 feet. It is quite different than the thickness used by Hume and Nauss. It would be a close figure to the Dougherty figure of 8.4. But I am applying it only to the central part of the field which I consider the commercial field. My acreage is about half of Mr.Dougherty's acreage, so 7.8 for 245,000 acres compares to 8.4 for 496,000 acres. Mr.Dougherty has a very much larger gas reservoir estimated, but substantially reduced, however, by the high connate water figure that he used.

I have discussed this Exhibit 35, Mr.Steer.

Q Yes, very well. Now, will you illustrate your views by reference to Imperial-Kinsella Well No. 18?

MR. C. E. SMITH: Just before you proceed, has this been given an Exhibit number?

MR. STEER: 35 was Mr.Davis's analysis.

Q I think, Mr.Steer, you are asking me to discuss the delineation of the boundary of what I am terming a commercial gas area?

MR. STEER: Yes.

(Go to page 1187)

A Well, I will undertake to do that by citing certain examples of where we differ. I think possibly before I proceed to do that, it might be well to introduce a couple of map exhibits.

Q Now, I think it might be well in the first place, Mr. Davis, if you were to distinguish between these two maps. Perhaps you would distinguish the two maps and then we will give them exhibit numbers.

A The lower right hand corner below the border line of the page is a date and on one of those maps you will note it is November 1948, and on the other it is September 1951. I would like to discuss first the November 1948 map.

Q Which we will give the exhibit number 36.

MAP DATED NOVEMBER 1948
PUT IN AND MARKED EXHIBIT 36.

Q And right now we might as well mark the other one Exhibit 37.

MAP DATED SEPTEMBER 1951 PUT
IN AND MARKED EXHIBIT 37.

A On information available to me and as interpreted by me in relation to sand thicknesses in particular, but to some extent influenced by the open flow capacity of wells either after completion or on drill stem tests, this map, Exhibit No. 36, was prepared in 1948, and on it I drew my outline of the proven commercial fields. At that time I did not include the area around Fabian because I had no notion that the Fabian field was not an extension of the Kinsella field, but I did not go on down because that Fabian area was producing gas or being used in Wainwright and my interest was in the gas available to Northwestern

Utilities and I was thinking of the gas field from which that company would obtain its supply. That was the reason for the limitation of my proven area to the east, for that reason and no other.

To the west I limited the extension of the field a couple of miles more or less from the Imperial Kinsella well No. 10, which is in Section 29 of 49-13. That well had, according to our judgment, 6 feet of pay but the pay was extremely tight. The well was a very small well, slightly more than 1 million cubic feet. Northwestern Utilities did not deem it a good enough well to extend a line to. At that time we were very firmly impressed that our best source of gas lay to the east of the old Viking field rather than to the west, and we did not believe we would ever go west of the proven area as I have drawn it to pick up gas from very small wells which we believed we would get out that way.

Now, I have explained that I drew the line around the area that I thought would produce commercial gas. I did not try to include areas that would have gas present but in quantities insufficient to justify drilling wells and laying lines to. I think in the light of my present knowledge, I think I have learned a little bit in two or three years, I think that I would modify that line today in one or two places in particular. I think in Township 49, Range 12, where I have included only, I will say, the southerly or southwesterly half of the township, I would be inclined to push my proven line north about a mile and a half where it crosses the

eastern border of that township that I have just named and let it run easterly and westerly by a little north so that I might include an additional 20 or 25 square miles, if I were doing the job today. And what has happened in there since 1948 to influence me? Well, it is a more careful consideration of the fact that my proven line along through the township just named and the one adjoining it on the east lies only about a mile from Imperial Kinsella well No. 23 which had 10 feet of pay in my judgment, the way I figured, and well No. 24 down in section 36 of 48-11. That well, I think, had 9 feet of pay, as did the well 3 miles straight east of it. I think I cut out 25 square miles more or less in there that today I would class as proven. I might be inclined to extend a little further to the west, too, toward Imperial Kinsella No. 10 to take in a little more. I realize that gas is flowing from the area of Imperial Kinsella No. 10 into the old Viking area. It is flowing slowly but it is flowing. That is information that I did not have in 1948. We have now the pressure decline on that well. I think the well was drilled in 1947. We now know that the well has been declining in pressure consistently. Otherwise, I have no apology to make for the area outlined by me as proven and I will try, if I am not taking too long here, to express a view of my --

Q Well, now, before you do that, Mr. Davis. You have told us that you would make certain extensions. Will you look at Northwestern Utilities well 28 in Section 35,

Township 48, Range 10?

A 48-10?

Q Yes?

A Section 35?

Q Yes?

A Well 28. Well, that well has had a bad history. Well, I can possibly review it briefly from memory. The well was completed as a good gas well, 12 million feet more or less, something of that order. It was turned into the line and produced nicely, clean gas with no unusual amount of water, for a period of several months, then suddenly and without forewarning something was the matter, they found the well was frozen up and full of water. Every effort was made to bring that well back. Every effort was made to find out where the water came from. Analyses of the water indicated the water to have a mineral content more nearly comparable to samples taken from other wells in the Viking sand than from any other water analyses of other upper sands. We believe the water is from the Viking and the efforts to get that well back into production were unavailing and the well has been abandoned.

Q Then will you look at well No. 38 in Section 18 of 48-9. I am looking at the top of page 6 of your notes there, Mr. Davis.

A I have got to get a map that has got that well on it. Yes, well 38.

Q I am looking at it on Exhibit 37. Is that what you are looking at?

Ralph E. Davis,
Dir. Ex. by Mr. Steer.

A I am now. I was looking at the older map. Well, well No. 38 was drilled, completed, casing set, and according to our judgment had a sand thickness of 6 feet. We expected a good well there but from the very start it made a lot of water and many efforts have been made to bring that well in as a gas well but it will produce, I believe, a stream of gas for 20, 24 hours and then it goes to water. Personally, I do not believe that well can ever be made useful. You have brought this to my attention in connection with my proven area but we have spots within the proven area as outlined by me that are not too good, they do not add much to our gas supply for Edmonton.

Q Yes?

A So I freely admit I could enlarge my proven area to some extent. There are some spots even within the old proven area that I could eliminate. I do not know what our experience will be in further drilling but there is no certainty that we can drill commercial gas wells throughout the entire proven area as outlined by me.

Q Now, you were going to discuss these estimates of reserves by reference to particular wells, and for that purpose we have marked these two exhibits 36 and 37.

A Don't you think, Mr. Steer, it would be a good idea for me to further discuss the two exhibits?

Q Very well.

A The first one, I believe, is No. 36.

Q That is right.

A And it was made in 1948. The net pay sand thickness was determined for every well for which we had information,

and these sand thicknesses were plotted on the map by the well. You will note that over in the old Viking area there is no sand thickness for any well. Those wells were all drilled in with cable tools. The personnel of the company does not know what the net pay thickness is in that area. Mr. Dougherty relied on those taken by Mr. Leisemer when Mr. Leisemer was employed by the Board during the period that those wells were drilled, at least, during the period that some of them were drilled. I contacted Mr. Leisemer a few days ago and talked with him about his estimates and the sand thicknesses, how could he estimate the sand at net pay thickness in the well that was drilled in with cable tools? Well, they were just the best he could do. I looked at his notes. He had one well with, I think, either 23 or 24 feet shown as the sand thickness.

Q Now, we are talking about a group of wells up there in the northwest corner of your black line on this Exhibit 36?

A Yes, wells that centre around the northwest corner of Township 49, Range 12. I do not believe that it is possible for a man to observe practically everything when the well is being drilled with cable tools to know what the net pay thickness might be. It would be difficult to know how much shale is present and shale breaks in the sand, it would be difficult. I submit that that is not a very sound basis upon which to estimate the sand thickness but in any case I have not attempted to place any definite thickness on those wells, but where-

Ralph E. Davis,
Dir. Ex. by Mr. Steer.

ever I did have what I thought was sound information I used the figure and in the 1948 map drew isobar lines presumed to go through points where the thickness would be about the same, and you will note that my isobars are on a 2 foot interval. I have the 8 foot, 10 foot, 12 foot isobars going down to the 6 and the 4. Based upon the information then available we drew those lines, we planimetered and determined the average sand thickness assuming the thickness between the two isobars such as the 8 foot and the 6 foot isobars, we assumed the average thickness in that area to be 7 feet, planimetered the area and had 7 feet, then likewise for each other. Then in the central portion I have a 12 foot isobar. I have one well, No. 26. Maybe you will note it in 48-10, Section 18, 14 feet of sand in that pay. In that area we assumed the average thickness of the pay in that irregular shaped area to be 12 feet. I beg your pardon, 13 feet, the outer perimiter being 12 and the highest point known to us 14, and we used 13. Now, I have talked at length about that but I think it is worth doing.

I would like to refer now to the other map, Exhibit 37.

(Go to page 1194)

You will notice quite a number of new or later wells that have been drilled since 1948, maybe 25 or 30 in number, and these wells have been completed and careful studies made of the pay thickness, and I have mapped the thickness of all wells where we have pay thicknesses, they have been spotted on the map, and in this month - is this still September?

BY THE REPORTER: October.

A September was a long month. Anyway, in September, and during the past two or three weeks, this map was prepared, and I found that my isobars had to be revised considerably from the older map on account of new information. We have got a lot of five or six or eight-foot thicknesses in an area centring around Township 47, Range 10, which on the basis of information available in 1948 we thought would be something like 10 feet.

Q MR. STEER: You are talking there about isobars, Mr.Davis?

A What did I say?

Q Isobars?

A I am talking about isobars, the sand thickness.

Q DR. GOVIER: Isopachs?

A Isopachs, I beg your pardon. Let us use isopachs where I have talked here about isobars for the last few minutes. In any case, this map has been presented now as one which I believe reflects a careful study of the sand pay thicknesses throughout the field. The map made in 1948 indicated an average sand pay thickness of 7.8 feet in the area of 245,000 acres, and this map indicates an average pay thickness of only 7 feet.

Q MR. STEER: They are in the same area?

A They are exactly the same area. We have lost here roughly 10% of our pay thickness as estimated, so, frankly, I am rather glad I did not reach too far in classifying acreage as proven. That estimate of gas reserves I made in 1948 will be hanging around for quite a while.

Q Now, I think, perhaps, while you are at it, Mr.Davis, that you might as well indicate what the other lines on this map are, the black line and the two dotted lines?

A Oh, yes. Well, there is a continuous and fairly heavy line which in the upper right hand corner of the field has my name "R. E. Davis". That is put there to indicate that that is the way I outlined the proven commercial field.

Q 1948?

A That is right.

Q And you have told us that you might be inclined to extend it a little to the north in Township 49, Ranges 10 and 11?

A Ranges 12 and 11.

Q Oh, 12 and 11?

A And a little in 10.

Q A little in 10, 11 and 12?

A Yes, a little in 10, 11 and 12. I not only told you I would be inclined to, I meant by that that I would.

Q Well, then, perhaps I used the wrong word?

A Well, we won't fight.

Q DR. GOVIER: Did you say, Mr. Davis, that that would add some 25 sections?

A Well, I have not planimetered it, I just considered how

long a stretch of country it is, and, well, it is about 14 or 15 miles long, and would average about a mile and a half in width, and by that I say it is about 25 square miles.

Q Do you intend that that figure be added to your figure of 245,000 acres?

A I have no objection at all for it to be. I do not consider it a sufficient or an addition of such magnitude that it matters much. What is 25 times 640?

Q 16,000.

A 16,000. It is a 5% addition, isn't it? Well, when I consider that I have lost 8/10 of a foot in my average thickness, if I were making a new report right now, I would add 25 square miles, more or less, and I would come down to a 7-foot thickness, that is what I would do, and I have not considered it essential at this time to go through that effort. It is easy for anybody to do it, anybody that wants to.

Q MR. STEER: Now, the bearing of these wells, 28 and 38, would that have a tendency to reduce the area?

A They would have that effect. Now, I do not know how much. All I can say is, I would add 25 square miles out there, maybe a little bit at the west end, and bring it down or bring it up to 27 or 28 square miles, and I would be also inclined to take out a few square miles and bring it down to 23 or 24 square miles, but I do not consider it to be a matter of any consequence in this business of estimating reserves.

Q Very well?

A I think it is a matter of grave consequence in the matter

of the Gas Company.

Q Very well. You were telling us about your own line, the R. E. Davis line?

A Yes, sir.

Q Now, I see a dotted line marked above your name with "G.S.Hume". I take it that is Dr. Hume's area?

A That is the area outline made by Dr. Hume.

Q And on Exhibit 35 you have given us that acreage as 366,000 acres, I think?

A That is right.

Q And above that you have got a line which is dotted with the name "DeGolyer & MacNaughton", and that is the plotting on this map of the area that Mr. Dougherty spoke of?

A As proven.

Q As proven area?

A That is right.

Q Now, have you told us what you wanted to tell us about these two maps?

A So far as the maps are concerned, I think so.

Q Yes. Then you were going to discuss different estimates as shown in Exhibit 35 by reference to particular wells, and you were going to start, I think, with Imperial-Kinsella well No. 18 in Township - in Section 27, Township 45, Range 10?

A Yes. That well is indicated on the map as an abandoned well.

Q Yes?

A And, according to my information, there was about three feet of sand. I think Mr. Dougherty gave it 16 feet. I am not sure. I think that is right. The electric log

of that well shows some very modest kicks in the Viking sand zone, and there is some porosity as proven by three drillstem tests. The first test was taken from 2105 to 2135, the second one from 2111 to 2144, and the third from 2105 to 2159, and the three tests reported, and I quote "Very slight gas blow", and on one of these is another statement which I will qiote "No gas or oil in commercial quantity".

Q Yes?

A Now, in my days those things have been called dry holes, where I came from.

Q Then I think you would like to tell us about Jarrow No. 1 in Section 20 of 45-10?

A I will speak of that well now because it is located only about 2 miles southwest of the well just discussed, and Jarrow No. 1 got a flow of gas which, according to the records in the geological department of Canadian Western, was from a sand about 183 feet above sea level. This is about 80 feet higher than would be expected in that location for the pay sands of the main Kinsella field. These sands, as all of you know, dip to the southwest about 10 feet to the mile. That varies somewhat, but that is about the way it is. The highest wells in the field are the wells up to the northeast, the lowest wells are those to the southwest. This well, according to our records, obtained its gas in a zone about 80 feet above where we would expect to get the Viking pay.

Q And where you did get it, where did you get it from the Imperial 18?

A I did not hear you?

Q Did you get it, the Viking pay in Imperial 18?

A Well, let us see, it is about 80 feet higher, as I have said, than would be expected in that location. The nearby Imperial-Kinsella No. 18 showed the top of the Viking at 133 feet above sea level. With Imperial 18 getting it at 133 feet above sea level, this well ought to get it at 100 or 110 above sea level. Instead of that it got it at 183 feet above sea level. The dip is to the southwest, 10 feet to the mile. Now, with doubt such as this as to the southward extension of the Viking pay sand, and with a dry hole only 2½ miles in towards the field, I cannot concur in the thought that the proven area of the Viking field can extend so far south. There is half a township there classed by DeGolyer & MacNaughton as proven that I would not class as either probable or prospective in the Viking sand.

Q I think you would like to discuss the Ranfurly well in Section 32 of Township 50, Range 12?

A Well, that Ranfurly-Texas-Superior, or the Texas-Superior-Ranfurly No. 1, was completed as a gas well for some 6 or 7 million cubic feet in the Viking sand. That well had been drilled when Dr. Hume made his report. In the general area there had been only two other wells drilled within five or six miles. One was Imperial-Kinsella No. 21, out in Section 28, Township 50 , Range 13, and the other was a well drilled on the shore of Birch Lake, you can all see it there. Dr. Hume, in his report, made this statement, "The elevation of the Viking sand in this well is about 140 feet higher than Imperial-Kinsella 10, about 9 miles southwest. Imperial-Kinsella

21, five miles southwest, and United Dominion Petroleum 1, on the shore of Birch Lake, four and a half miles to the southeast, were dry holes." In his country they called them dry holes although these two wells do not prohibit extending to the Texas-Superior-Ranfurly No. 1, they strongly suggest there is no connection. The extent of the gas-producing area around the Ranfurly well is unknown, and can be determined only by further drilling. Well, that is what the Texas-Superior people must have thought, because they stepped out and drilled Number 2 Ranfurly about four miles north of Ranfurly 1. That well is not shown on this map. It is roughly four miles north and one mile west. Unfortunately, that was a dry hole. Then they stepped out into Section 12, Township 50, Range 13, and they drilled a well, Texas-Superior-Ranfurly No. 3, which is four miles southwest, no, from four and a half to five miles southwest, four and a half miles southwest of Ranfurly 1, and, unfortunately, they for what I believe you would call a dry hole. Anyway, it is abandoned. However, they still thought something of this area, and I do not blame them for that, and they moved along and drilled a well in the section directly south of Ranfurly No. 1, and,as everybody knows that followed this hearing, that also was a dry hole. Now, if Dr. Hume could cut off that area as being part of a gas field on the basis of only the Imperial-Kinsella No. 21, and the United Dominion Petroleum well over by Birch Lake, I think that anybody with Ranfurly's 3 and 4, I believe I would, having regard to that acreage, I would also say the proven area does not extend into that area.

Q You agree with Dr. Hume?

A I sure do.

Q And perhaps Dr. Hume agrees with you?

A I think he would.

Q Now, you were going to discuss some other individual wells later on, Mr.Davis, but I am going to ask you now, whether in the light of this discussion you stand by the estimate of the preven reserves in the Viking-Kinsella Field which you have made?

A I do. I stand by my estimates. Did you ask me only as to acreage or as to estimates?

Q Acreage?

A Acreage?

Q Yes?

A Well, I stand by my estimates of acreage, subject to such qualifying statements as I have made here today, and for the principal reason that within the area of my proven field, proven commercial field, we have, out of 8 or 9 wells that have been drilled, only 3 or 4 that are not of some commercial importance, fair wells to good wells, and in that entire area outside of my proven area, where between 20 and 30 tests have been made, only 1 and 2, possibly, calling that Jarrow well a well in another sand, and the Imperial No. 10, which I do not consider much of a well, a million 3, not worth running a line to at this time,you got 20 or 30 abandoned dry holes, or mostly dry holes, and I would say I would stand by my acreage.

Q Yes? Have you anything to say about the quantity of gas remaining after a gas field is abandoned as a source of pipe line gas?

A Well, I would say that as gas fields reach the stage that we describe as abandoned, I think we are generally thinking of abandonment for the purposes of supplying pipe line gas, and there always is a remaining amount of gas in a field, where small amounts of gas can be available. Take the Panhandle Field, when it is no longer useful to supply the big pipe lines that go out of it, I think there will be a gas supply there sufficient to take care of such cities as Amarillo and Pampas, for 100 years, and maybe 300 or 400 or 500 years, I do not know, but there will be no gas for a major pipe line. When we are talking about pipe lines and the pipe line gas supply for it, we are talking about pipe line gas. But in order to go a little further on this subject, as a field reaches that stage of abandonment, and I judge it on the basis of a good many gas fields, that I have seen reach that stage, on the average they cover roughly 85% of the gas. That figure varies through a rather wide range, 60 or 65 up to 95. When you get 95% of the gas out of a field, you have a very beautiful sand, porous, of high permeability, and the gas just flows easily. But when you get only 60 or 65%, you have a sand of tight, shaly to some extent, low permeability. The abandonment for pipe line purposes comes when the gas is costing more to put into the line than other gas that can be obtained elsewhere would cost.

Now, we talk about abandonment pressures. I talk about 200 pounds at the wellhead; others talk about 100 pounds. But, in any case, I think it certain that in a field like Viking, there will be

portions of the gas rock that will carry gas at substantially more than the figures indicated as the average pressure at abandonment for the reason that the gas does not flow easily, as we know it flows rather slowly. Take these Viking wells. Those wells, if you take a test and they flow all summer, and then you take a test in the fall, and there is no apparent increase. The wells build up, and stabilize essentially, with this great Kinsella portion of the field available to pour gas into the Viking area, but it is doing it at so modest a rate that we did not know it was doing it for a long time. For a long time it was considered by Mr.Slipper, who was Chief Geologist of the Canadian Western.....

Q And Northwestern?

A And Northwestern.

Q Yes?

A That the Kinsella area which had been tested with 2 outlying wells, was probably part of a greater field, Viking being one part of it, the Eastern extension being another part of it. We held that view for a long time. And when the growth of the company demanded greater supplies of gas, that was when Western applied or acquired a substantial acreage to the east, you will note, and not to the west, for development. And when we drilled those wells in that acreage to the east, we found virgin pressures.

Q Indicating?

A That whatever drainage there may have been, and I will admit there must have been a slight amount, a little bit, that it had not been of any importance. That is about all.

Q Do you want to proceed now and discuss sand thicknesses?

A Well, I think I have already told you of the sand thickness when I discussed this Exhibit 35, used by several of us. I have told you how I used 7-8/10 feet in 1948, and this year I used 7, or would have used 7, if I were doing it again.

Q And you have discussed the maps?

A Yes.

Q I think you were going to deal with sand thickness by reference to certain particular wells?

A That is right. I did not understand the implication of your question, Mr. Steer.

Q Yes?

A I am interested in the net thickness of the pay that will produce gas. I am not too much interested in that rock that is so tight it won't produce much of anything, produce a little over a long time, but in a gas field I am interested primarily in the net pay, and to illustrate how we have developed in our studies of those near by, I have selected 7 wells. They are Northwestern Utilities Kinsella wells, 22, 23, 26, 27, 31, 38, 54, those are all the wells, and I would like to. . .

Q Just a moment, Mr.Davis. We have reproduced the material with respect to each of those wells which you are going to discuss?

A That is right.

MR.C.E. SMITH: Will you repeat the number of the wells?

MR. STEER: Yes. Northwestern Utilities Kinsella 22, 23, 26, 27, 31, 38 and 54.

MR. C. E.SMITH: Thank you.

MR. STEER: These will be marked as one exhibit, I take it, sir?

THE CHAIRMAN: Yes, I think that would be all right.

MR. STEER: That will be Exhibit 38?

THE CHAIRMAN: Exhibit 38.

DOCUMENT IN QUESTION MARKED EXHIBIT 38.

THE CHAIRMAN: I think this would be an appropriate time to adjourn for a few minutes?

MR. STEER: Yes, sir.

(Hearing resumed after short adjournment).

Q We are sorry this was not done at the intermission, sir. Mr. Davis, you were going to discuss these wells that are referred to in this Exhibit 38?

A Yes, sir. The first well, No. 22, which is in Section 1 of 48-12. This well was drilled through the sand zone, casing set, and you will note from the electric log that the Viking sand, which is topped at somewhere in the neighbourhood of 2180, that just about it there are a couple of kicks on both sides of the log indicating the possibility of gas in that zone from about 2175 to 2180. To determine whether or not there was gas present in that zone perforations were started at 2172' 3"; the second shot at 2172' 6"; the third shot at 2173'; the next one at 2173' 3"; the next one 2173' 6"; the next one at 2174' 0", and the last one 2174' 3". You all have copies of the detail of this that I was just reading to you. Now, from those seven perforations there was a very small show of gas, too small to measure, from the seven shots called the shots of the first gun. Then a further procedure was to start shooting at 2175', 2176', 2178', 2179', 2180', no increase in gas. At 2181 gas increased, and at 2182 a further gas increase.

MR. PORTER: Perhaps Mr. Davis might at this point tell us what method of measurement was used when he comes to the conclusion of too small show of gas, "too small to measure". Was that through 7 inch pipe or drill stem?

A May I ask Mr. Patterson?

MR. PATTERSON: Pitot tube reading on 1 inch

pipe, water planimeter, which would read any small value which was measured.

A THE WITNESS: So we find the top of this sand to be at 2181. I might call attention that after getting gas at 2181' a further increase at 2182' on 5-minute open flow pitot reading was 7-1/10 million per day, that is, at that rate. The third gun perforation at 2180 and 2186 inches, 5-minute reading then was 10-2/10 million a day. So they went on perforating that well, as the notes show. There was a slight increase after perforating down to 2182' 3", and the reading was 10-8/10 millions, and after perforating down to 2184' 9" the reading was 11.4. After perforating down to 2186' the reading was 12.2. After perforating down to 2188' 6" the reading was still 12.1, and then re-perforating from 2181' down to 2182' 10" in order to increase the flow, the reading was 12-9/10 millions. Now, on a basis of that I concluded, working with Mr. Patterson of the Gas Company, we worked together on this, that it was fair to conclude that we had 10 feet of pay. Mr. Dougherty found 14 feet.

The next well on that list is well No. 23.

Q DR. GOVIER: Mr. Davis, I wonder if you would mind indicating to us how you arrived at the 10 foot figure?

A 10?

Q Yes. Did you read that from the log?

A Yes, reading it from this log after finding we had our first flow of gas that could be measured as a top and going on down until we got no further increase. I quoted

10 feet. The electrolog would indicate about 10 feet if you eliminate any sand above 2180'. We eliminated it by testing it.

Q Thank you.

A Now, if I may go to well No. 23. That is in Section 27-28-11. The tabulation of information is shown here but I would just like to touch upon it. At 2072' very little gas, too small to measure, and that was true to 2072' pulling the gun up in the hole and coming up to 2070'. At 2072', you see, we perforated to get at the base of the sand. We want to determine where the bottom of the pay sand is and so we start in at 2072' and there is a little gas, too small to measure, which is explained here that there was a small leak or leaks in the casing which had built up a pressure of 15 pounds over night prior to the gun perforating. Well, whether that very little gas too small to measure was due to that leak does not matter at all. We did not have any gas of importance until we perforated at 2069'. They came up then to 2056'. I think we have found the bottom of the gas. Now, we come up to 2056' looking for the top of it and there was no apparent increase. At 2056' 6" there was a large gas increase, 5-minute open flow pitot tube reading 5-9/10 millions a day, so from 56 to 69 that is the interval between the bottom and the top gas flows. That would be 13 feet. We cut that down to 12 feet because from the core we knew we had about a foot of shale breaks that could not be contributing this gas at this time, at least, some day there might be a little gas come out of

that shale but it won't be important. We have 12 feet, Mr. Dougherty has 14 feet. There is not much difference, just a little difference. Mr. Dougherty is not always on the high side. You will find pretty soon one where I am on the high side.

Well No. 18 in 48-10, you will note from the electorlog that something begins to happen about --

Q Are you talking about 18? The next one I have, Mr. Davis, is 26.

A I am sorry. Have I got these out of order?

Q That is the next one in your list, 22, 23, 26.

A Oh, you want me to take 23 next?

Q No, you have discussed 22 and 23.

A Now, what do you want?

Q The next one is 26.

A Good. That is the one I started to discuss.

Q You called it 18.

A I looked at the wrong spot here. It is in Section 18 of 48-10, and it is well 26.

Q That is the kind of a mistake I made the other day in making those additions of gas.

A You and I both make these mistakes. You catch me and I'll catch you.

Q All right.

A Well, you will note from the electrolog that something begins to happen -- I will tell you the depth, right around 2170'. The electrolog indicates that something is happening there. Down at about 2190' and below 2190'

Ralph E. Davis,
Dir. Ex. by Mr. Steer.

we have electrolog indication of possible gas between 2190' and 2200'. The important thing we thought -- that is, I did not think at the time, Mr. Patterson thought that the important thing was the first test that lower zone was there. There was no gas in it between 2190' and 2200', so between 2192' and 2198' 6" that zone was perforated with 14 shots and no gas was found. That kind of washed that out. The detail of that is shown on the printed page. That is from 2193' down to 2198' 6" no gas. Coming up the hole to 2191', a little gas. At 2189' a small increase. At 2188' a large increase. That defines fairly well the bottom of this gas zone. They came up the hole with a 4th gun to 2173' 6" and perforated from that point down to 2175' 9" and had a 5-minute open flow reading there on pitot tube of 4½ million a day, so the further perforating was to obtain production. The detail is shown here and it ends up with 12.2 million feet per day.

Q DR. GOVIER: Mr. Davis, was any attempt made to measure gas flows resulting from the individual shots up at the 2173' level?

A Well, the records in our files, so far as I know, do not indicate any such detail. I think Mr. Patterson would know whether an attempt was made between 2173' and 2175' 9", those fourth gun readings, whether or not there was any.

MR. PATTERSON: There were no measurements. Every measurement that was made was shown.

Q DR. GOVIER: So there is no way of telling

whether the top of the sand is from that 5-minute pitot tube reading?

A Except you know it is somewhere between 2173' 6" and 2175' 9".

Q Or above 2173' 6"?

A Yes, above 2173' 6", and we have the gas at about 2189'.

Q What would your interpretation of the electrolog be, Mr. Davis?

A Well, after such experience as I am now relating to you, if we had a new well drilled out there at this time and we picked up an electrolog just like the one I am looking at here, I would hesitate to give the pay thickness anything in that secondary lower zone of modest electrolog indication. After finding out by experience that the gas is mainly in the better electrologged zone than in the poorer, if I were reading them before I saw such tests as these -- I would have to count these spaces because the prints are poor. I might have given it 20 feet. I might have put 16 feet in that zone I am calling the upper and better zone, and I might have given it 3 or 4 feet in the lower one that turned out to have nothing.

Q But I am right, am I not, that you had no tests in the intervals 2170' to 2173' 6"?

A 2170' to 2173' 6", that is right.

Q And yet that is an interval which on the electrolog might be considered a likely one, is it not?

A My print is so poor I want to see where this is on the electrolog. From 2170', is that your question?

Q Yes?

A To 2173' 6". You take a good look at that, sir, and I do not think you would. I do not believe you would be inclined to include that.

Q Thank you.

A In any case, I gave this thing 14 feet. The difference between my top gas and lowest gas is 15½ feet. I cut it down to 14 on the basis of shale breaks observed in the core. Mr. Dougherty gave it 23 feet. What well is next, Mr. Steer?

Q MR. STEER: The next one is 27.

A 27 in 33-48-10. The first perforation was at 2062' as shown in the notes, very little gas, too small to measure. At 2061' no increase. Up through 2057' 8" but coming up now to 2057' 4" a large increase in gas measuring 4-9/10 million per day on a 5-minute pitot tube test. We got the bottom of that sand pretty well logged at 2057' 4". Now, the second perforation was at 2048' well above any indicated sand on the electrolog. That is well above, 2 or 3 feet above. And at 2048' and also at 2048' 2" no increase. At 2048' 4" gas increase. Then the perforations continue until we get to 2049' 2" and a 5-minute pitot tube reading of 14 million. Additional perforations were for the purpose of increasing flow. After the 7th gun we had an open flow reading of 21-4/10 million. Now, my estimated sand thickness there is 9 feet, Mr. Dougherty's 10 feet, and I do not see much to quarrel about. Is the next well No. 31?

Q Yes, 31.

A All right. The first perforations at 2179'. We are

perforating now from bottom upward. 2179' no gas; 2177' very little gas, too small to measure; and no increase down to, or up to 2163', and we had a large increase. Now, we come up the hole and start at 2152' and got no increase. At 2154' no increase. At 2154' 6" no increase. At 2155' no increase. At 2155' 6" a large increase. I think we have got the top and bottom of this thing tied down. My estimate of the sand is 8 feet, Mr. Dougherty's is 12.

The next well is No. 38 in 18-48-9.

Q DR. GOVIER: Mr. Davis, would you mind going just a bit slower, please.

A Okay, sir. Go ahead but slow?

Q If you please.

A All right. The first perforation was at 2128', above the point that one would expect to get any gas. At 2128' no gas. At 2141' no gas. At 2140' 6" no gas. At 2140' no gas. At 2139' 6" appreciable gas. Now, we come up the hole to 2132' 6", no increase. At 2133' we got a small increase, and the remaining shots were fired for production. The 2nd gun there were 30 shots. I do not seem to know what the capacity of that well was. What is our record of that, Mr. Patterson, do you know?

(Go to page 1214)

MR. PATTERSON: We did not take any readings at that time. It ended up about 10 or 12 million to a well.

A 10 or 12 million to a well.

Q Yes.

A Apparently from Mr. Patterson's understanding or knowledge of it, no test was taken at the time the well was being completed, but later it turned out to be a well good for 10 or 12 million. I gave that a thickness of 6 feet, Mr. Dougherty 7 feet. Again, we are close enough. The next well, I guess this is the last well, Kinsella No. 54 - am I going slow enough, Dr. Govier?

DR. GOVIER: Just fine.

A Located in section 6 of 48, 10. If you will look at that electric log you will wonder what is wrong. Maybe it is wrong with the device that was trying to find a porous sandy body. In any case it did not look very good on the electric log. It would be very difficult for me, Dr. Govier, to make any estimate of sand thickness based upon that electrical log information.

Q It would be impossible for me, Mr. Davis.

A I would think fairly impossible.

Q Yes?

A Now, they started perforating at 2180. I do not know whether they were looking for the bottom of the sand or looking for a sand. Anyway, at 2180 they got no gas. They came up to 2172 and no gas. 2171, none. 2170, none. 2169, no gas. 2168, no gas. But at 2167 feet and 6 inches they got a fair gas flow. Now, they come up the hole to 2156 and 6 inches and they got no increase, but at 2156 feet 7½ inches they got a small increase. The remaining shots

that were fired were, of course, for production. Judging the sand to be in that interval between the top and the bottom of gas flows, I estimated the thickness at 11 feet, Mr. Dougherty at 20.

It has been the practice of the gas company in recent years, and they drill 8, 10 or 11 wells a year out there, to set casing through the sand and to perforate, not always in accordance with the scheme I have been telling you of here, wherever it seems practical or desirable to do so, and as a result we have a considerable amount of information about sand thickness.

Q MR. STEER: Now, you have already dealt with porosity and connate water?

A Well, I have mentioned how we had different figures for connate water. The information, I think, was by others. They relied upon the Imperial information and we did not.

Q Yes. You have told us how you made estimates or how you had estimates made in a laboratory as to the amount of connate water?

A That is right.

Q Now, other factors, such as temperature, pressure, and supercompressibility, I understand there are no essential differences between you?

A No difference.

Q We are dealing now with the comparison that you have made that is found in Exhibit 35?

A That is right.

Q Now, then, I would like you to discuss, if you will, abandonment pressures?

A Well, if we are talking right now about this Kinsella field, and I think we are. . .

Q Yes, we are.

A . . . there were several different assumptions made. Dr. Hume did not present any amount in regard to the estimate he gave of his gas in place and he let you make up your own mind how much you are going to get. Dr. Nauss, I think I have said before, if I understand his report correctly, he used 100 pounds bottom hole pressure as a so-called abandonment pressure. DeGolyer and MacNaughton used 150 pounds bottom hole pressure, which would be something higher than the top of the well pressure. I suppose the top of the well pressure at that time, when we have got 150 at the bottom, it would be 140 at the top. I have not figured it out. It is not too far from that. I used 200 pounds at the well head. That would be about the same as 224 at the bottom of the hole. There is a difference of about 24 pounds. Dougherty's well head pressure would be about 165 pounds. Well, I do not have any quarrel about that. None of us know what this field is going to do in its final stages of production. It may be that what Mr. Dougherty thinks is likely; it may be what I think. However, if I were responsible for people using gas in this country I would not lean to the optimistic side when I made an estimate. I would not lean in that direction, and I think with a sand having as low a permeability as this sand has, a sand that has such a low quantity of gas in it per acre, which makes it uneconomical to drill wells close together, in my judgment it is ridiculous to talk about a well here to every

square mile. I think that those items are going to result in what I am referring to as abandonment pressure, higher than it would be if we did drill a well to every square mile, and it is not, in my judgment, economical. I do not know that it ever will be, but, in any case, I cannot say what might be economical 25 years from now. Today it would not be economical. Is that what you wanted, Mr. Steer?

Q What have you to say about gas migration?

A I beg your pardon, Mr. Steer. Well, migration of gas will depend upon various matters, with permeability being a very important one. The greater the permeability, naturally the more easily gas will flow. The pressure differential that will be created by the withdrawal of gas from a well, or a group of wells, or from the central portion of a gas rock, the pressure differential between that and the pressures existing in the outer portion of that sand rock will be important. A cross-section of the channel, that is whether the channel be a foot, two feet, three feet or five feet, will be a matter of importance. And I think from a practical standpoint, and in a field like this Kinsella field, the greatest factor of all is time. If we had a field that had great permeability, very great permeability, I think that gas would flow rather readily from undrilled areas and even through a distance of several miles, but where we have sand that we know is in many spots low, or has, in many spots, low permeability, I think that the time element will be very important. I have studied such things as this and the Munro field might be interesting as

an example.

The proven area of the Munro field is about 400 square miles, roughly 256,000 acres, and that area is about equal to the proven area, as I have mapped it for Viking-Kinsella. You have a proven field about the same size as my proven area for Viking-Kinsella. The main gas pay in the Munro field is a porous chalk called there the "Munro gas rock". That gas rock varies in thickness, but it is roughly 30 feet thick, and the porosities range up to more than 30%. It is remarkable that they can have, as I know from tests, 25 or 30% porosity and permeabilities than range down to about 1 millidarcy. If it were not for flow channels there would be very little gas flow from the low permeable rock to any well.

The initial closed well head pressure of that field was about 1035 pounds. In the early days wells gauging 10 million and more were common. Estimates of the ultimate recoverable reserves to an assumed abandonment pressure of 50 pounds per square inch at the well head approximate 6 trillion cubic feet. We think the total gas ih the reservoir is about 6-7/10 trillion. We think that the recovery will be close to 6. This field was discovered in 1916. By 1918 rather heavy gas withdrawals began to invade the rapidly growing carbon black industry. Quite a number of carbon black plants were put up there because gas was very cheap and the location was very good. Now, that was from Akron and other centres of the rubber industry.

Between 1922 and 1930 a number of

long distance pipe lines were built, the first being to Alexandria, Louisiana, then a line to Baton Rouge, and then later an extension to New Orleans, then to St. Louis and one to Atlanta and Birmingham. And in 1929 was the maximum well drilling programme. The total gas withdrawals to January 1st, 1951 have been 4 trillion 700 billion cubic feet, and we have still got about 1 trillion 3.

Now, the average pressure in the central portion of the field where production has been heaviest is now about 25 pounds at the well head. That area of 25 pounds gas covers about 1/16 of the total area of the field. The gas is gathered in low pressure lines, and because of the extremely low pressure it is used in two carbon black plants. The cost of compressing it to get it into pipe lines to go to St. Louis would practically preclude it from the industry. The high pressure gas in the field is gathered and being compressed feeds the Inter-State lines. Over on the left side of this field development has been slow. Wells are of small size, generally ranging up to about 2 million cubic feet a day open flow, up to that, but they will average less than a million, I think.

Since January 1st, 1951, several wells have been drilled in the west side of this field and I have their records of those wells to illustrate how gas flows in rock of low permeability, even though the thickness be 30 feet, and even if the differential in pressure is the difference between 25 pounds and 1000 pounds. I will state that 9 wells drilled in 1951 had closedwell head pressures

ranging from 920 pounds to 1020 pounds, the average being measured at 986-7/10 pounds well head pressure. And every one of these wells was drilled within a half a mile. No, I beg your pardon. One well a quarter of a mile from a producing well, another a half, another a quarter, another a half, another a half, another a quarter, another a quarter, one well one-eighth, and another a quarter. I was right. They were all drilled within a half of a mile of an older producing well, but average pressures in 1951 were 773 pounds.

I cannot assume that just because gas is present that we know it is going to flow in a quantity sufficient to be considered important commercially in anything but a long, longtime.

Q I do not think you discussed the significance of the figures of the 1951 pressure in the nearest well. Did you want to deal with that?

A Oh, the nearest wells, these wells I have just mentioned have a 1951 pressure of 773 pounds.

Q 773 pounds average?

A Average. One of them had 560, another 730 and so on, but 773 average, a difference of 213, and located, on the average, only a half a mile away. And a low pressure area covering 1/16 of the entire field where the well head pressure averages only 25 pounds. Take it for what it is worth.

Q DR. GOVIER: Did you indicate the permeability for that field, Mr. Davis?

A Well, my knowledge is based on just a long contact with the field. My first work was done in that field shortly prior

to 1925, and in those years we never did any electrical logging, nor coring, just drilled wells and completed them. We now have a good many electric logs of wells and cores, and we know that the Munro gas rock is a peculiar gas rock, and in that it does have a pretty high porosity and the permeability varies greatly. There are permeable streaks throughout this gas rock that tend to bleed the gas. The more permeable streaks have gas in them, and the gas feeds into them. I have tried to go backwards in an estimate of how much of that gas rock would be required to hold 6-7/10 trillion cubic feet, knowing my area, and assuming that the average porosity was 30% with regard to them, and from tests made it would probably be not greater than 30%, I find that it would require a body of rock underlying the 400 square miles 30 feet thick, which makes me believe that the gas rock, even though it be highly variable in its permeability, is the feeding gas. But I point out . . .

Q Excuse me. Were there any permeability measurements on these recently drilled wells that you referred to?

A I feel sure there were not. I do not know, but I doubt very much. Those wells were drilled by people who were farmed out acreage from Inter-State Natural Gas Company. I see that of the 7 wells, or I see that 7 wells were on farmed out acreage, and I do not believe that those operators would be interested in spending money for the permeability information.

Q It is difficult to interpret the pressure differential, Mr.Davis, unless we have some idea of what the permeability is there, is it not?

A We know as much about that as we know about the permeability out here in Township 50, Range 12. We do not know anything about either one.

Q MR. STEER: Will you continue your discussion of the Monroe field?

A That is all I wanted to say.

Q I understood that as of 1950 you estimated for use before the Federal Power Commission, the Securities and Exchange Commission and financing, what the total gas in place was. You have given us that, haven you?

A Well, I did that in studies that we presented to the Federal Power Commission, the S.E.C., and the financial people.

Q All right?

A I made such estimates during the past 12 months.

Q Wereyyou going to discuss the Fulcher Basin and Pictured Cliff areas?

A Well, I would want to say that we have in the San Juan Basin in northwestern New Mexico a formation called the Pictured Cliff sandstone, where gas pools have been found that are commercial, and gas is being produced from those fields, particularly the Coutts Canyon Field and the Fulcher Basin Field, and now in a field to the south and in alignment with the other two,or three fields, and they are confidently regarded as interconnected, and the production in Fulcher Basin and Coutts Canyon has lowered

pressures from about 600 pounds down to an average of probably 300 pounds, and yet the extension into the south end of that continuing field, into an area called the Hargreave area, has practically virgin pressures. The distance is just a few miles from one to the other. The gas moves slowly through rock of low permeability. That Pictured Cliff sandstone outcrop is only 15 miles or 20 miles west of these gas field I am telling you about, and the outcrops and gas seepages that are known there have undoubtedly been gas seepages for thousands of years. The gas has not travelled 15 miles in a sufficient volume to bleed the gas fields of their reserves. I only tell you what I think about it. I think gas will move slowly in a rock of low permeability.

Q Well, will you come to the Viking-Kinsella Field and tell us whether, in your view, gas in volume of importance will pass from the general area of the outer border of the so-called proven area of the DeGolyer and MacNaughton maps to the inner part of the field?

A I am one who would say that the minute they started taking gas out of just one well, that there is a tiny, slight, unmeasurable effect to the limit of the field, wherever that is, if there was interconnection. However, from the standpoint of gas flow, I do not think any gas man would be inclined to count upon any reserves available from a distance of four or five miles of the wells. I do not think he would. He might count on some from the first mile or two.

Q Perhaps you would give us your reason?

A Because the gas travels too slow in rock of that kind,

that is the reason.

Q I see. Now, is there any other observation you would like to make on the Viking-Kinsella Field before we leave it?

A I think we have covered a good deal of it already.

Q Yes. Well, then, perhaps you will tell us what your views are as to Pincher Creek?

A My views as to Pincher Creek are possibly already known in previous testimony that has been before the Board. My view has not been, has not changed since the time I was before this Board before. I have regarded Pincher Creek as a field that undoubtedly has very great gas reserves. I think I have said heretofore that I would expect the field to have a reserve of 1 to 2 trillion feet. That would be my judgment of it. But when we get to talking about what is proven and what is a judgment figure, now I am going to submit some ideas. In the first place, we know there is proven reserves there, and we know it is a large proven reserve. The question is, how are we going to figure on it? The mapping of the structure has been done, I am sure, competently. I have no thought that the field is not as extensive as the map indicates the areas to be. The Mississippian shows a very low porosity through several hundred feet, porosities which, I understand from the Gulf testimony, range from $2\frac{1}{2}$ to $3\frac{1}{2}$, more or less, per cent. Those are porosities, as I understand it, determined from certain core samples, and did not take into account structures in the rock. The gas in Pincher Creek is, to a greater or lesser extent, present in fractures. How much is in

R. E. Davis,
Dir. Ex. by Mr. Steer.

fractures, how much is in this rock of low porosity, I do not know; but it is the gas in the fractures that is surest to come to the surface. Now, what about the fractures? The three wells that are known to be substantially gas wells could have a large volume of production. However, if I understand it correctly, they did not drill along the axis of the structure, pretty nearly in a straight line. Generally, according to my studies in geology, where you have a limestone or a dolomite that has been bowed into an anticlinal structure, it is common to find the fracturing more - fracturing along the axis than along the flanks of that structure.

(Go to page 1226).

A And I have always had not any doubt that the field was a great field but I have had some doubt that we could apply ordinary arithmetic to it and say we have 14,000 acres and we have so many hundred feet, 2 or 3 per cent porosity, and figure the thing out that way. I do not believe it is that simple. I also believe that a well was drilled on the flank hoping to find possible oil but whether it found oil or not, according to the testimony in the record here, the upper pay zone in this field was notably lacking in fractures as compared to the two wells that had previously been drilled on the axis. And I say that, not because I am inclined to deprecate the field, I want it to be a 3 trillion foot field. I would like to see this thing go that way but until we know that that fracturing does exist throughout a large portion of the 14,000 acres we do not know how much gas could be recovered even if it is present. Gas is not going to flow very far through a rock with 2½ or 3 per cent porosity unless there are fractures or bedding floors that will furnish avenues for flow. I am not going to talk any more about Pincher Creek except to say I regard it as a field of great potentiality, but when it comes to putting 1½ trillion feet in there, I will go along with anybody that we know that the fracturing extends down the flank.

Q Now, then, what studies have you made of the area which we have been calling Princess-Patricia?

A Well, I made a report on that field back in 1947 for the United Carbon Company who thought it possible they might have a gas supply in there suitable for feeding gas to a

carbon black plant.

Q Well, have you made efforts since that time to bring your studies up-to-date?

A Yes. I tried to follow Mr. Dougherty and possibly if I could have found him present here in the city during the last several days I would have had more success. I wanted to check up on some data that he had been able to get and that I have never found. I know sometimes one of us finds something and the other fellow does not. I wanted to check up on that and I went to the Standard of California, or what do they call it, California Standard, and they referred me to the Conservation Board where they said I would find all of the information that I wanted. I went to the Conservation Board, that is, my associate, Mr. Gollnick, who is entirely qualified to pursue such studies. He went there and did not find some of the information that Mr. Dougherty had at his disposal, so we are not able to check Mr. Dougherty's findings.

Q In detail?

A In detail.

Q Very well. Then perhaps you will give the Board the benefit of your general views on the Princess-Patricia area.

A Well, I would say this, that the gas that has been estimated for that area has been, and everybody knows it has been, found in the hope of finding oil and we do not have a developed gas field out there. We have areas out there in which the gas has been found in wells, and whether it is 100 billion cubic feet of reserves, as I think the

Board has estimated, whether it is 300 more billion feet, as others have estimated, I will say that it is not at this time a suitable source of gas supply upon which people should invest their money in pipeline building until more wells have been drilled and more gas has been definitely proven. Some of those spots out there that have estimated gas reserves, you can not build a branch line to a gas pool that has 10 billion cubic feet of gas, not unless that little line is to be about a 1-mile line, 2 at the outside. You have got to have enough gas to justify branch lines to these various pools. Some of them may turn out to be pretty good, I do not know. I say you have got to have more drilling. Take Princess at any figures that have been put in as a source of pipeline gas, and that goes for my old estimate of 40 billion, of the Board's estimate of 101 billion, Mr. Dougherty's estimate of 300 or 400 billion, it does not make any difference, they still do not have the proof that would justify anybody in starting financing the construction of a line out of that place.

Q There was evidence given yesterday, I think, Mr. Davis, that wells might be produced on an annual basis up to 75 per cent of their open flow capacity. Would you deal with that question?

A Yes. I was here when Mr. Hawthorn was discussing the availability of gas for a proposed pipeline to Winnipeg and Minnesota and he indicated that by taking more than 25 per cent of the open flow the required amount of gas could be obtained from the field that he named up until

about 1966 or 1967. In that I understood him to say that he would secure permission, I believe, and start taking 28 per cent of the open flow, then 31 or 32 and keep on until finally he got up to 100 per cent. Then in response to cross-examination he said 100 per cent was not a practical idea, that he would reduce that to 75 per cent.

Now, what I would like to say on the subject is this, that I know of no place in the gas country, which includes everything from New York State to the Los Angeles basin where anybody has ever put into a pipeline 75 per cent of the open flow day in and day out during the whole year unless there be possibly a figure close to that which has been reached in brand new wells. I have in mind a small gas field discovered a couple of years ago in Pennsylvania in Leidy Township where one well came in with 140 or 150 million open flow, very high pressure. That well put 50 million feet of gas into the pipeline day after day, month after month, against 3,000 pounds back pressure. I think if you are ever going to get 75 per cent of the gas, of open flow, it is going to be when the wells are fairly new. When you get down in the later years like 1967 in this case you are going to have a situation more like that which surrounds Columbia Gas who operate in Ohio, West Virginia, Pennsylvania, Kentucky, New York, people who have had experience now with many thousands of gas wells. Their gas pools from which they take gas would be somewhere in the order of 600 or 800. I have seen them depleted down to nothing, and I have been familiar with that outfit ever since 1921

when I did my first work for them and my last work for them is in the office now being handled. I am familiar with their production and I can tell you that they are not able in the coldest day when they want every foot of gas they can get, they are not able to take 75 per cent. For a few days they might get 50 per cent from some of the wells, but generally in the winter time they get closer to 35 per cent.

I had occasion to do some work a few years ago for a gas company up there at Chatham, Ontario. What is the name of that company?

MR. NOLAN: Union?

THE WITNESS: Union Natural Gas of Canada Limited. I have done work for them over a period of 20 years but for two or three years, along about 1947, '48 and '49, I guess, I would go up there in the fall and try to figure out with those people what amount of gas they could expect to get out of each of their several fields in the coming winter, and we based our estimates on the experience in previous winters, modified, however, to take into account the declining pressure of the wells and the declining open flows. We would make our estimate and then in the spring of the year following we would find out how good or how bad the estimate was. They had one field that did during several winter months actually deliver into the pipelines about 55 per cent of the open flow. Another field hit 55, but they did hit between 40 and 50, and there was the case of taking every foot of gas they could get.

I had occasion to do a job for the Ontario Government about three years ago in connection with the available gas supplies, what could be expected, similar studies, similar results. I know of no place where one could expect to take 60 to 75 per cent for 365 days. The only place you can get 50 per cent is where you rest your wells six months and then produce them six.

Q MR. STEER: Now, you have told us, Mr. Davis, that your view is that on the evidence before the Board today the time is not ripe for the export of gas, and perhaps you would conclude by giving us your views again on that question.

Q Well, I am of the opinion that one could not possibly finance a major pipeline, even though this Board granted a certificate, on the present picture. I would like to see that thing change, and change rapidly. I would like to see Canadian Western and Northwestern Utilities put in the position of feeling secure with regard to their future supply. Neither of those two companies feel secure today, and I do not feel secure for them. I do not know where we are going to get the gas that we need. Certainly, I know there is a lot of gas in Pincher Creek. There has been so much talk around here about building pipelines, newspaper talk, people talk, until now we have just got pretty nearly a scramble and everybody expecting we are going to build a pipeline out of here, and I think it is not the time. I hope the time will come, and I have said before, and I say it again, if it were a smaller project such as taking gas down there into Montana, 35, 45 million feet a day, I would not object a minute. I would like to

have the Board know that the last job I did for the Montana Power Company was at least five years ago. I am not retained by them now nor since then. I consider them my friends but I have no more desire to help them up here than I have to help Delhi or anybody else.

MR. PORTER: Can you imagine that.

MR. C.E. SMITH: I thought he was going to tell us that.

Q MR. STEER: Have you anything more?

A I hope not.

Q That is all, sir.

THE CHAIRMAN: Any questions of Mr. Davis?

MR. McDONALD: Mr. Davis did not submit anything in the nature of telling us what he was going to say. I think we should stand over our cross-examination until tomorrow.

THE CHAIRMAN: Has anybody any views on this matter or would you like to postpone cross-examination until tomorrow?

MR. McDONALD: Mr. Davis mentioned yesterday some geologist on his staff was going to give evidence. It might be advisable to have it all together before we examine Mr. Davis.

MR. STEER: We do not intend to call any other evidence.

MR. McDONALD: Oh, well.

EXAMINATION BY DR. GOVIER:

Q Mr. Davis, you may recall when you were on the stand some months ago you told the Board about a study you have initiated of a number of fields in the south, in the Gulf Coast area. Have you been continuing that work, Mr. Davis?

A Yes, I have.

Q I wonder if you could tell us whether it has brought any conclusions that might bear on some of our problems?

A Well, it has very slight relation to your problems here. There might be something in it of value to you. I had a few of these notes sent up here after I got here thinking of your interest in it. I would be just glad to give these out. I do not think they should be put in as exhibits because they have not much bearing, but you can judge that for yourself.

THE CHAIRMAN: I think we might give this number 39.

STUDY ON GULF COAST AREA
BY RALPH E. DAVIS PUT IN
AND MARKED EXHIBIT 39.

A The background, Dr. Govier, of this graph information is as follows: The Federal Power Commission became insistent upon having presented to it studies of gas deliverability for any pipeline project, and that became a great chore if it had to be done by the methods that had previously been followed of using back pressure potential tests and if you had a known slope like 0.85 use it, and if you did not have one, why guess at it. From the average potential of the known wells you would estimate that new wells

might be equally good. You could figure out how many you needed and it was just a lot of arithmetic and took a lot of time, and I had in mind the possibility of first just doing an equally good job without so much work, and when I got through with it I became convinced that the method that I will discuss here is better if it applies to your picture. I do not think it applies here in Alberta at this time, at least, but what it is in effect, I have taken a gas field, gas pool, that has been, let us say, produced to abandonment. Let us say the field had in it 100 billion field that it produced. Let us say that the record of pressures and production indicated to a student of the subject that there had been left in the reservoir, let us say, 15 billion feet unrecoverable gas. I took the total gas in place in this field, 115 billion, and called it 100 per cent of the gas in place. Then I found out from the records what the gas production was in each year from the beginning to the last and expressed that in the per cent of the total gas in place, and I found that had for this field a graph starting in the first year with a small percentage of the total gas in place because I only had one or two wells, but as wells were completed and the field became drilled up we are going up the page and got up to a plateau of production governed more by market demand than it was by anything else until this graph started down the page. I found it usually started down the page when we had reached a depletion of about 65 per cent of the field, in some cases less than 65, even as low as 40. In some cases it was up to 75 and

80 when that production decline became marked and sharp, and I took for that field the figures available to me during the last few years of production, and although these graphs on this page do not illustrate that one field, I would just assume one of these, let us say, graph "C", is a graph of this one field, and I found that when that field was still able to produce and had produced 15 per cent of all the gas in the reservoir in one year, it did that when the field still contained 50 per cent of its total reserves. Do you follow that on the graph?

(Go to page 1236)

Q DR. GOVIER: I see. I am not clear, though, whether the initial reserve in place is based on marketable gas or is it raw gas?

A Raw, complete gas.

Q But the annual withdrawal is expressed in terms of marketable gas?

A It is the same thing. In every one of these fields there was, the reserves in the field that are involved in no case deal with the sulphur gas, they are dealing with a gas which, if it contained liquid products, that was taken into account in estimating the total reserves, so that I had reduced my total gas reserves to gas. All right. When this reservoir was able to produce 10% of all of the gas in the reservoir, I found that I had reached 59% depletion, and when that was down to 5% capacity, I had reached 70% depletion. You just follow the curve down, and you read at the bottom the per cent depletion of all gas in place, and the figures at the left hand side show the per cent of gas actually taken out of the reservoir in a year. All right, that is done for one field. I began looking around for depleted fields, and I came up with 24 in the Gulf Coast area and graphed every one of them, then I averaged them, and I made a graph of the average of 24 reservoirs, and that graph is the one marked "A" on this page. It happens to run down through the centre. That is 24 reservoirs. Then in criticism raised of this scheme of mine, especially by people who did not want it to work, and in evidence before the Federal Power Commission, it was said that my reservoirs, too many of them were from fields in the Tertiary fields of Texas - no, there were too many,

I remember now, in North Louisiana, and not necessarily in the Tertiary, I think more in the Cretaceous, but I did not have enough in the Tertiary. So I picked out of the 24 fields 16. They were located in North Louisiana, Mississippi and East Texas. There was a geographical location of the fields, and it was also a somewhat different geological age. And I prepared an average graph of those 16, and that is the graph "B", which is slightly better than the average of the 24. Then I took the remaining 8 reservoirs and made an average of those, and that is the graph "A" - no, graph "C". After all that had been done, we found 8 more depleted reservoirs to study. I put 8 in with the 24, and I had 32, and I made a graph for the 32, and that is the graph "D" on this thing. Then I searched the country from California to New York and I found 12 fields, depleted reservoirs, two were in California, one was in Wyoming, one in Oklahoma, one in Kansas, two in Michigan, one in Ohio, and there were fields, one or more, in West Virginia, Pennsylvania and New York. None of them were in Texas or Mississippi or Louisiana. They were scattered from California to New York, and in rock ranging from the Tertiary down to the Oriskany, and I made a graph of the average of these 12 and that is the graph "E". What good is this stuff? Well, in the first place I find that we abandoned these fields, abandonment was reached at a point on the average of about 86% of total gas in place. That is where these lines stop.

And I also feel, and I know, and this is again in the average field, I do not think this

would apply to a great field, well, like any field that is so large as compared to the annual production that we are never going to be able to take out as much as 5% in a year. I would not apply it to the Monroe Field, or the Panhandle Field, or I would not apply it to Turner Valley, or any of your bigger and better fields. This is based upon a study of reservoirs ranging from a top of about 500 billion feet on down, with most of these fields at 40 to 100 billion cubic feet.

Well, does it have any further use? I think I could feel that if I had a field or fields that were not large, that were of this general nature, that I should expect to see declining production when depletion has reached an average of about 65%. I am sorry if it is not of any more use to you, sir, in your problem.

THE CHAIRMAN: We will adjourn now, if it is satisfactory.

MR.PORTER: Mr. Chairman, before we adjourn, I would like to ask Mr. Davis, or his clients, to produce tomorrow for study by the Board, and use by counsel, the reports which Mr. Davis said this morning that over the years he has made to these companies on the occasion of the acquisition of reserves for financing. I think it would be a useful addition to the information which we have had, and will give us a fine basis for a progressive study of the problem of production, and the weight we ought to give to these necessarily varying things.

MR. STEER: Those will be produced to the extent that they are available, sir.

MR. C. E. SMITH: They are the reports to Northwestern Utilities and Western Natural Gas?

MR.PORTER: They are the financing reports.

MR. McDONALD: Mr. Chairman, if I might mention before we adjourn that Pacific Petroleums Limited, Canadian Atlantic Oil Company Limited, and Peace River Natural Gas Company Limited, desire to make representation to the Board, which has been prepared, and we can follow with the presentation after the Hudson's Bay, or any other convenient time.

THE CHAIRMAN: Do you want to make it now?

MR. McDONALD: No, sir, the witness left at 12.30, but I can distribute copies of it.

MR.DAVIS: May I ask a question, Mr. Steer?

MR. STEER: Yes.

MR.DAVIS: On account of travelling arrangements, I want to ask if I will be definitely through by tomorrow at 1 o'clock?

THE CHAIRMAN: That is up to counsel.

MR. DAVIS: I am asking counsel with regard to it.

MR.PORTER: Well, it all depends how long it takes you to give up, Mr. Davis.

MR. DAVIS: I have a notion to give up now. What do you think about it?

MR. PORTER: We will do our best to let you get away.

(Hearing adjourned until 9.30 A.M., October 3rd, o951).

The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

Application for Permission to Remove or cause to be removed Natural Gas from the Province of Alberta, under the Provisions of the Gas Resources Preservation Act by Prairie Pipe Lines Limited.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session:

Volume_____